

## 9972GS-VB Datasheet

# N-Channel 60-V (D-S) MOSFET

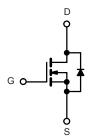
PRODUCT SUMMARY		
V <sub>DS</sub>	60	V
$R_{DS(on)} V_{GS} = 10 V$	11	mΩ
$R_{DS(on)}$ $V_{GS} = 4.5 \text{ V}$	12	mΩ
I <sub>D</sub>	75	Α
Configuration	Single	

#### **FEATURES**

- 175 °C Junction Temperature
- Trench Power MOSFET







N-Channel MOSFET

Parameter Gate-Source Voltage		Symbol	Limit	Unit
		V <sub>GS</sub>	± 20	V
Continuous Dunin Courset (T. = 475 °C)b	T <sub>C</sub> = 25 °C		75	
Continuous Drain Current (T <sub>J</sub> = 175 °C) <sup>b</sup>	T <sub>C</sub> = 100 °C	l <sub>D</sub> –	50 <sup>a</sup>	
Pulsed Drain Current		I <sub>DM</sub>	200	А
Continuous Source Current (Diode Conduction)	I <sub>S</sub>	50 <sup>a</sup>		
Avalanche Current		I <sub>AS</sub>	50	
Single Avalanche Energy (Duty Cycle ≤ 1 %)	L = 0.1 mH	E <sub>AS</sub>	125	mJ
Maximum Power Dissipation	T <sub>C</sub> = 25 °C	D.	136	W
	T <sub>A</sub> = 25 °C	P <sub>D</sub>	3 <sup>b</sup> , 8.3 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	- 55 to 175	°C

THERMAL RESISTANCE RATINGS						
Parameter		Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient <sup>a</sup>	t ≤ 10 sec	$R_{\text{thJA}}$	15	18	°C/W	
	Steady State		40	50		
Maximum Junction-to-Case		R <sub>thJC</sub>	0.85	1.1		

#### Notes:

- a. Package limited.
- b. Surface mounted on 1" x 1" FR4 board.
- c.  $t \le 10 \text{ s}$ .

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1



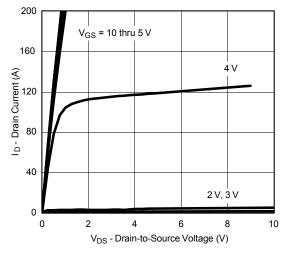
Parameter	Symbol	Test Conditions	Min.	Typ. <sup>a</sup>	Max.	Unit	
Static			L		<u> </u>		
Drain-Source Breakdown Voltage	V <sub>DS</sub>	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	60			\/	
Gate Threshold Voltage	V <sub>GS(th)</sub>	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	1		3	V	
Gate-Body Leakage	I <sub>GSS</sub>	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$			± 100	nA	
		V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V			1		
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C			50	μΑ	
		V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175 °C			250		
On-State Drain Current <sup>b</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> = 5 V, V <sub>GS</sub> = 10 V	60			Α	
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A		0.011		1	
	<sub>D</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A, T <sub>J</sub> = 125 °C	0.016				
Drain-Source On-State Resistance <sup>b</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A, T <sub>J</sub> = 175 °C		0.020	0.020		
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 15 A		0.012			
Forward Transconductance <sup>b</sup>	9 <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 20 A		60		S	
Dynamic	•			•			
Input Capacitance	C <sub>iss</sub>			4300			
Output Capacitance	C <sub>oss</sub>	$V_{GS} = 0 \text{ V}, V_{DS} = 25 \text{ V}, f = 1 \text{ MHz}$		470		pF	
Reverse Transfer Capacitance	C <sub>rss</sub>			225			
Total Gate Charge <sup>c</sup>	$Q_g$			47			
Gate-Source Charge <sup>c</sup>	$Q_{gs}$	$V_{DS}$ = 30 V, $V_{GS}$ = 10 V, $I_{D}$ = 50 A		10		nC	
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>			12			
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>			10	20		
Rise Time <sup>c</sup>	t <sub>r</sub>	$V_{DD}$ = 30 V, $R_L$ = 0.6 $\Omega$		15	25		
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>	$I_D \cong 50 \text{ A}, V_{GEN}$ = 10 V, $R_g$ = 2.5 $\Omega$		35	50	ns -	
Fall Time <sup>c</sup>	t <sub>f</sub>			20	30		
Source-Drain Diode Ratings and Cha	aracteristics (	T <sub>C</sub> = 25 °C)		_			
Pulsed Current	I <sub>SM</sub>				60	Α	
Diode Forward Voltage	V <sub>SD</sub>	$I_F = 20 \text{ A}, V_{GS} = 0 \text{ V}$		1	1.5	V	
Reverse Recovery Time	t <sub>rr</sub>	$I_F = 20 \text{ A, di/dt} = 100 \text{ A/}\mu\text{s}$		45	100	ns	

- a. For design aid only; not subject to production testing. b. Pulse test; pulse width  $\leq 300~\mu s,$  duty cycle  $\leq 2~\%.$
- c. Independent of operating temperature.

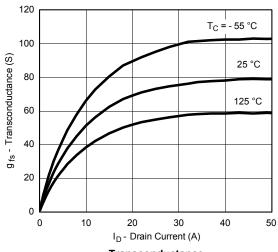
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



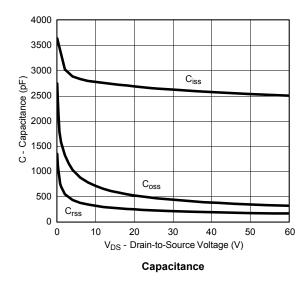
#### TYPICAL CHARACTERISTICS (25 °C unless noted)



#### **Output Characteristics**

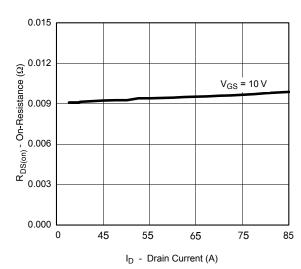


Transconductance

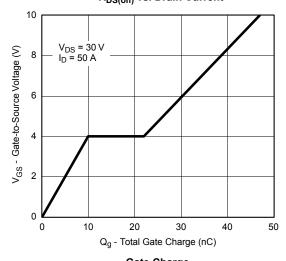


100 80 I<sub>D</sub> - Drain Current (A) 60 40 T<sub>C</sub> = 125 °C 20 25 °C - 55 °C 0 0 1 2 3 4 5 V<sub>GS</sub> - Gate-to-Source Voltage (V)

**Transfer Characteristics** 



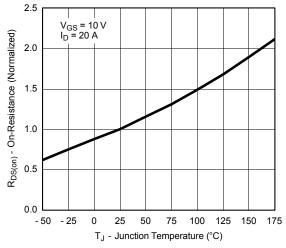
R<sub>DS(on)</sub> vs. Drain Current



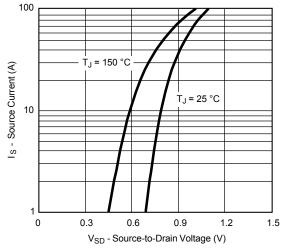
Gate Charge



### TYPICAL CHARACTERISTICS (25 °C unless noted)



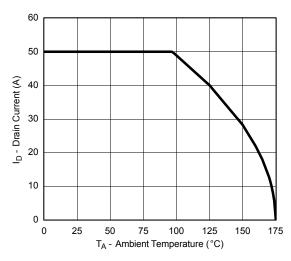
On-Resistance vs. Junction Temperature

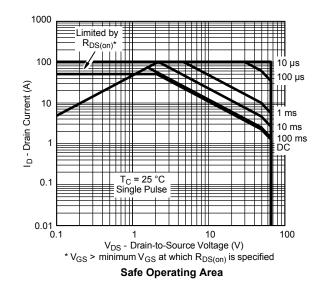


Source-Drain Diode Forward Voltage

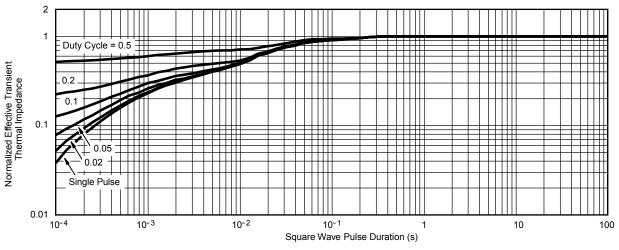


#### **THERMAL RATINGS**





Maximum Drain Current vs. Ambient Temperature



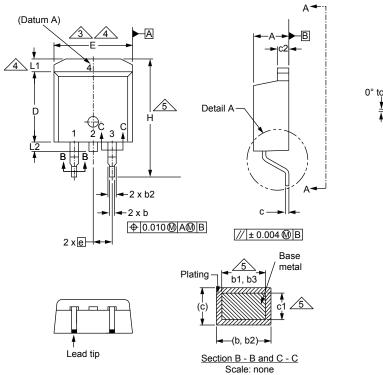
Normalized Thermal Transient Impedance, Junction-to-Case

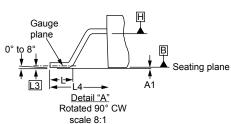
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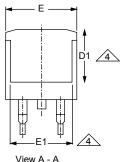
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#### **TO-263AB (HIGH VOLTAGE)**







	D1 4
— E1 — ►	<u>4</u>
View A - A	

	MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.	MAX.
Α	4.06	4.83	0.160	0.190
A1	0.00	0.25	0.000	0.010
b	0.51	0.99	0.020	0.039
b1	0.51	0.89	0.020	0.035
b2	1.14	1.78	0.045	0.070
b3	1.14	1.73	0.045	0.068
С	0.38	0.74	0.015	0.029
c1	0.38	0.58	0.015	0.023
c2	1.14	1.65	0.045	0.065
D	8.38	9.65	0.330	0.380

	MILLIMETERS		INC	HES
DIM.	MIN.	MAX.	MIN.	MAX.
D1	6.86	-	0.270	-
Е	9.65	10.67	0.380	0.420
E1	6.22	-	0.245	-
е	2.54	BSC	0.100 BSC	
Н	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	-	1.65	-	0.066
L2	-	1.78	-	0.070
L3	0.25 BSC		0.010	BSC
L4	4.78	5.28	0.188	0.208

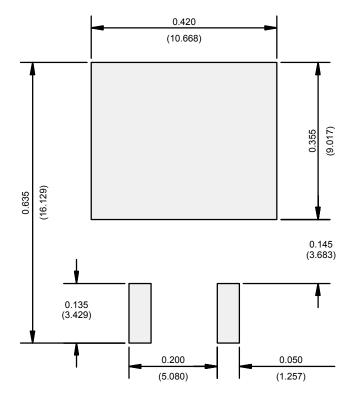
ECN: S-82110-Rev. A, 15-Sep-08

DWG: 5970

- 1. Dimensioning and tolerancing per ASME Y14.5M-1994.
- 2. Dimensions are shown in millimeters (inches).
- 3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body at datum A.
- 4. Thermal PAD contour optional within dimension E, L1, D1 and E1.
- 5. Dimension b1 and c1 apply to base metal only.
- 6. Datum A and B to be determined at datum plane H.
- 7. Outline conforms to JEDEC outline to TO-263AB.



### RECOMMENDED MINIMUM PADS FOR D<sup>2</sup>PAK: 3-Lead



Recommended Minimum Pads Dimensions in Inches/(mm)



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